

388.312
tst
1974-75

MONTANA'S

Traffic

STATE DOCUMENTS

JAN 2 1975

Operation

Projects to

Increase

Capacity and

Safety

PROGRAM

F. Y. 1974-75

Montana State Library



3 0864 1006 4258 9

T O P I C S E V A L U A T I O N R E P O R T

FOR FISCAL YEAR 1974-1975

STATE OF MONTANA

Prepared by

MONTANA DEPARTMENT OF HIGHWAYS

PLANNING AND RESEARCH BUREAU

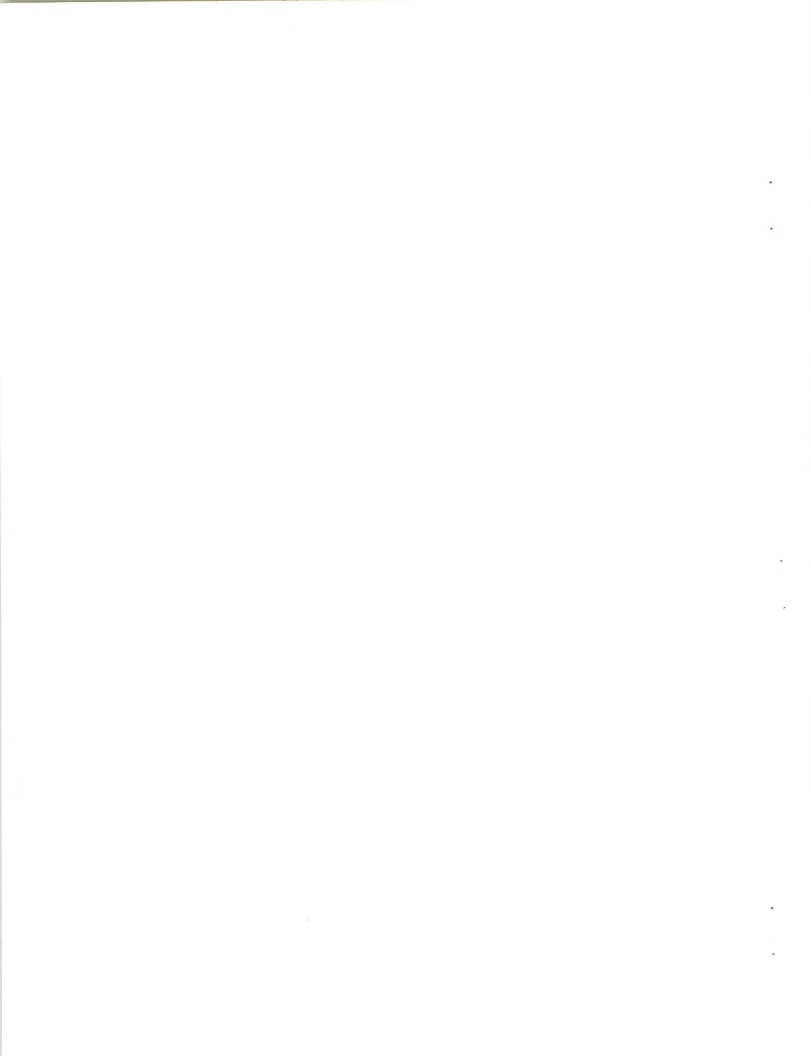
in cooperation with

U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION

September 1, 1975

REF. 620.4



TOPICS EVALUATION

INTRODUCTION

Pursuant to Par. 9, Sec. 2, Chap. 8, Volume 6 of the Federal-aid Highway Program Manual, this topics evaluation report is submitted.

Topics planning reports were prepared using HPR moneys for all cities in Montana with a population of 5,000 or more. These planning reports are the basis upon which spot improvement or topics type projects are programmed. For many of the smaller cities, the topics report is the only documentation for transportation planning purposes. Urban funds are now being used for projects that were recommended in the topics planning reports since topics funding has been discontinued.

PROGRAM EVALUATION

The objective of the topics program is to improve the safety and efficiency of a city's street network through the application of well established traffic engineering techniques which have proven successful in the past.

The applications of these traffic engineering techniques requires engineering expertise. At the time of the inception of the topics program in 1968, only one city in Montana had a traffic engineer on its staff. Now, four cities have traffic engineers and several of the smaller cities have hired consulting engineers on a retainer basis.

The Montana Department of Highways has hired five engineers, trained them in traffic engineering principles, and placed them in the five field divisions which have the larger cities.

In order to insure that the expanded traffic engineering expertise is applied to those activities that will provide the maximum increase in efficiency of urban streets, the Department of Highways has worked closely with the thirteen urban areas. For each urban area, the State and the city worked out an arrangement of available talent that could work on traffic engineering problems and evaluations. Four cities, Billings, Great Falls, Missoula, and Helena, have professional traffic engineers in their city staffs. Each of these engineers is a member of the Technical Advisory Committee. Three cities, Bozeman, Havre, and Kalispell, have professional civil engineers on the city staff. Consulting engineering firms are providing traffic engineering services to Anaconda, Bozeman, Butte, Glendive, Lewistown, and Miles City on a retainer basis. The five division traffic engineers of the Department of Highways provide their services to cities when requested. The thirteen cities and the State have worked out individual arrangements to apply the available talent to local traffic engineering problems. The Program for Providing On-Going Traffic Engineering Service for the City of Anaconda is a typical example and is included in the appendix of this report.

With this greatly expanded expertise in traffic engineering, the State and many Montana cities have installed traffic control devices that are in 90% or greater conformance with the MUTCD. The safety and operational efficiency of the transportation networks of the cities is thereby improved although the contribution of low cost improvements such as signs, markings and traffic signals to the safety and efficiency of the system is difficult to determine. Efforts to measure this increase in safety and efficiency and the resulting cost effectiveness of projects

should be expanded.

In order to insure that limited Federal and State highway funds will be available for Topics-type projects two cities, Billings and Great Falls have committed a certain percentage of these allocated funds to these Topics-type improvements. By this method the local officials will prevent the depletion of all their highway funds by a major project taking several years of allocated funds.

In the last fiscal year eight topics type projects were completed and put into operation as shown by Table I. At the end of the fiscal year there were seven topics type projects under contract and construction, as listed in Table II. These projects, as well as the projects completed, were well distributed among the various cities of the State. In addition, there has been five Topics-type projects funded with local funds.

At this time there are also 57 projects that have been programmed and are in the design stage that have been developed primarily from topics planning reports.

TABLE I

TOPICS-TYPE PROJECTS COMPLETED F.Y. 1975

	<u>Project Number</u>	<u>City</u>	<u>Type of Improvement</u>	<u>Cost</u>
1.	T-9067(1)	Kalispell	Traffic Signal & Lighting U.S. 2 and Meridian Road	\$ 35,000
2.	UF 269(10)	Helena	Traffic Signal & Lighting Montana Avenue and Custer	55,000 *
3.	F 277(11)	Great Falls	Traffic Signal & Lighting Tenth Ave. South & 32nd & 49th Streets	53,500
4.	M-5204(2)	Great Falls	Traffic Signal Modification Fifteenth St. and River Road	10,500 *
5.	T-9010(19)	Billings	Implement one-way Streets	25,500
6.	M-1020(3)	Billings	First Avenue North Lighting	53,500 *
7.	M-5112(2) M-7111(1)	Billings	Implement one-way Streets Montana Avenue and First Avenue North	305,000
8.	T-9050(1)	Glendive	Illumination & Drainage Barry Street Underpass	14,500 *

LOCALLY FUNDED TOPICS-TYPE PROJECTS

1.	C.B.D. One-way	Billings	Signs & Signals 2nd & 3rd Ave. N.	160,000 *
2.	Traffic Signal	Billings	Intersection of Grand Ave. Third St. W.	29,000 *
3.	Traffic Signal Update	Great Falls	Improve traffic signals at three intersections	21,000 *

TABLE II
TOPICS-TYPE PROJECTS UNDER CONSTRUCTION

	<u>Project Number</u>	<u>City</u>	<u>Type of Improvement</u>	<u>Cost</u>
1.	M-TM9018(1)	Butte	Harrison Avenue-Widen Olympia to George Street	\$100,000 *
2.	F215(25) + F9999(5)	Missoula	Signs and Traffic Signals	317,000
3.	ML206(2)	U-1 Bozeman	One-way couplet	28,500 Equipment * Only
4.	F999(7)	Helena	Signs and Traffic Signal	167,000
5.	M5205(2)	Great Falls	15th St. with No. & So. River Roads, Revise Signals	16,800 *
6.	ML020(2)	Billings	New Signals and widen U.S. 10 and Moore Lane	206,000
7.	ML099(2)	U-1 Billings	4th & 6th Avenue North on Exposition Drive	24,500 Equipment * Only

LOCALLY FUNDED TOPICS-TYPE PROJECTS

1.	Traffic Signals	Helena	Upgrade traffic signals at three intersections	\$ 75,000 *
2.	Topics Project No. 7	Helena	Straighten jog on Broadway at Montana Avenue	\$ 60,000 *

Total of Projects undertaken in F.Y. 1975
Thirteen Projects

\$854,300

* Projects undertaken in 1975 fiscal year

EVALUATION OF COMPLETED PROJECTS

Evaluation of completed projects is made to determine if the benefits predicted for the project at its inception have proved valid. Projects can be evaluated on the basis of cost/benefit, cost effectiveness, reduction in accidents, improvement in operating measures such as speed, capacity or delay. The evaluation of a project is based on operating conditions on the site of the project before improvement, as compared to conditions existing following completion of the project. Accident histories, the usual criteria to evaluate safety improvements, require time periods measured in years because of the rare occurrence at a particular location. The improvement in capacity can be calculated even before the project is built. Delay can also be estimated with reasonable accuracy for a planned project.

Projects selected for evaluation for this report are listed in Table III below.

TABLE III

<u>Project</u>	<u>Location</u>	<u>Type of Improvement</u>
T-9081(4)	Missoula	New traffic signal Intersection of Arthur Avenue & 6th Street
T-9081(5)	Missoula	New Traffic Signal-Intersection of Arthur Ave. & Beckwith Ave.
T-9081(6)	Missoula	Remove signal-Intersection of Arthur Ave.- & University Ave.
T-9052(7)	Great Falls	Intersection improvement Central Ave. W. & 6th St.
T-9052(6)	Great Falls	Park Ave.-Widen two blocks Second Ave. N. to Central Ave.
T-9010(4) M-5112(2) M-7111(1)	Billings	Montana Ave. & First Ave. N. Implement Couplet
T-9010(18)	Billings	Remove jog at intersection Lewis Ave. and 8th St. West

T-9081 (4), (5) & (6) Missoula - Arthur Avenue and
Sixth Avenue South, University Avenue and Beckwith Avenue

Arthur Avenue is a north-south street which provides access to the campus of the University of Montana and its surrounding residential area. Traffic volumes on this street vary from 4000 to 9000 A.D.T. Two of the cross streets, Sixth Avenue South and Beckwith, have traffic volumes which warrant signalization.

Three intersections of Arthur Avenue were improved as part of the first TOPICS Projects constructed in Missoula. The contract cost of these three projects was \$47,000.

The intersection of Arthur Avenue and Sixth Street South was experiencing a high number of angle type collision accidents. In 1970 flashing beacons, illumination and traffic control devices were installed at this intersection under a State funded project. These improvements did not significantly improve the accident situation. A project to install traffic signals was let to contract in 1972 and the construction completed by June 27, 1973. In the two years following the installation the accident rate has shown a significant reduction. In the two years before the signal installation there were 9 accidents that occurred at this intersection, while in the year and a half following the installation only 2 accidents occurred.

A fixed time, single, four-way traffic signal had been installed over the intersection of Arthur and University. University is an east west street with the east leg being closed to vehicular traffic. The traffic signal had been installed for the benefit of pedestrians wishing to cross Arthur to and from the University of Montana. Neither the volume of pedestrians nor vehicles was sufficient to warrant continued use of the

traffic signal. Unnecessary delay was experienced by vehicular traffic on both Arthur and the west approach of University as well as to all pedestrians. An agreement was worked out with the city to revise the signal to a flashing beacon with red indications for University and amber indications on Arthur. In the year and a half following the installation of the flashing beacon there has been no reported accidents occurring at this intersection as contrasted to the two years before installation in which four accidents occurred. None of these accidents involved pedestrians.

Beckwith Avenue is the main street for access vehicular traffic onto the campus of the University of Montana. The volume of traffic using Beckwith was great enough to warrant traffic signals. Both approaches of Beckwith were controlled by stop signs and during peak hours long delays were experienced by Beckwith traffic. The TOPICS Project to install traffic signals at this intersection also provided parking restrictions to provide two lanes for all approaches and curb return radius were increased to facilitate right turns.

The operation of this intersection improved because of this project with overall delay being reduced and redistributed to all approaches. The accident history showed improvement following the installation of the signals. In the year and one half after installation 4 accidents occurred, while in the two years before installation, 7 accidents were experienced.

PROJECTS T-9081 (4), (5) & (6) ARTHUR AVENUE-MISSOULA



Sixth Ave. South
T-9081(4)



University Ave.
T-9081(5)



Beckwith Ave.
T-9081(6)

INTER-DEPARTMENTAL MEMORANDUM

STATE HIGHWAY COMMISSION OF MONTANA

riannin

RE

AUG 1

To Paul Devine - P.E. - Chief - Planning & Research
Bureau

Date

July 31, 1975

From James T. Sullivan - P.E. - Supvr. - Div. Const.
SectionSubject: Topics Evaluation
Annual Report 1975

In response to your memo of July 7, 1975 the following is submitted as our annual topics evaluation for 1975.


The intersection of Central Avenue West and 6th Street was completed in March, 1974. Under this contract, new actuated traffic signals were installed and parking removed from each approach to provide more room for additional traffic lanes. A leading green arrow was installed for left turning traffic from Central Avenue West onto 6th Street S.W. These improvements have decreased delay time and increased the capacity at this intersection. The major improvement at this location is the increased safety as reflected in the accident rates. Prior to construction there were 51 accidents in a three year period, or about 17 accidents per year, for an accident rate of 2.52 accidents per million entering vehicles. For the 17 months following completion of the project, the intersection experienced 17 accidents, for an accident rate of 1.75 accidents per million entering vehicles. The number of injuries has fallen from 2.3 per year to only one during the 17 month period after construction.

The intersections of Park Drive at First Avenue North and Central Avenue were completed in January, 1974 at a cost of \$154,200.00. Under this project, both intersections received new actuated traffic signals and additional traffic lanes by widening of Park Drive. The installation of double left turn bays from Park Drive onto First Avenue North and Central Avenue has provided adequate capacity for the large turning movements at these intersections. Overall travel time for vehicles entering and leaving the Central Business District by Park Drive has been reduced.

At Central Avenue and Park Drive the overall accident rate in a three year before period was 2.97 accidents per million entering vehicles. For the 19 month period following completion of the project the intersection experienced 17 accidents, with only 1 injury for an overall accident rate of 2.76 accidents per million entering vehicles. Forty-seven percent of the accidents in the after period were rear end collisions.

At the intersection of Park Drive and First Avenue North, the overall accident rate in a three year before period was 2.39 accidents per million entering vehicles. Due to a large number of rear end collisions, the overall accident rate during the 19 months following completion of the project increased slightly to 2.88 accidents per million entering vehicles. However, when one examines the severity rate, it is found that there were 7 injuries for an accident injury rate of 3.75 injury accidents per 10 million entering vehicles in the before period. During the 19 month after period there has been no injury accidents, for an accident rate of 0 injury accidents per 10 million entering vehicles.

JTS/RHJ/r
cc: R. Jacobson W/Atch.


Avoid Verbal Instructions

TOPICS PROJECT T-9052(6) PARK DRIVE, GREAT FALLS



Before Project



After Project

Views Looking North

INTERSECTION PARK DRIVE AND FIRST AVENUE NORTH



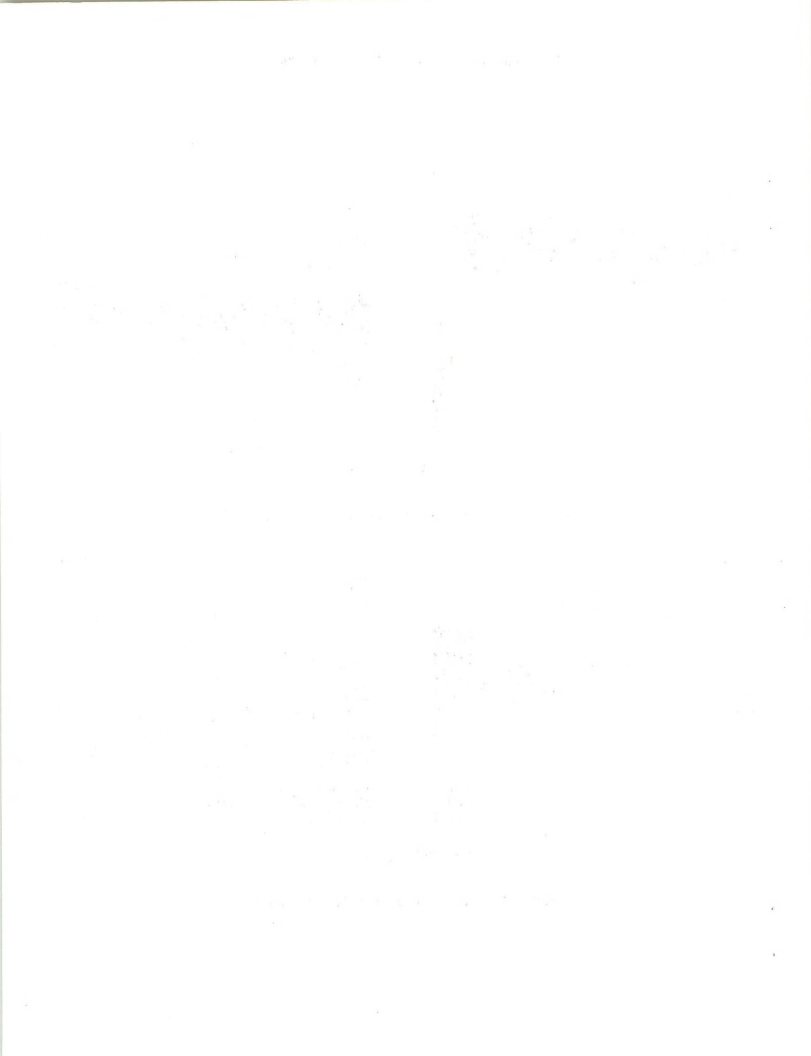
Before Project



After Project

Views Looking South

INTERSECTION PARK DRIVE AND CENTRAL AVENUE



MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT
ACCIDENT ANALYSIS
COLLISION DIAGRAMCITY OF Great Falls COUNTY CASCADE
INTERSECTION OF Central West AND 6th St.
HIGHWAY NUMBER _____
PERIOD COVERED 3-1-74 7-30-75
COMPILED BY JACOBSON DRAWN BY _____ DATE 7-30-75

LEGEND

- PASSENGER KILLED
- PEDESTRIAN KILLED
- PASSENGER INJURED
- PEDESTRIAN INJURED
- ← PROPERTY DAMAGE ONLY
- ← COLLISION - REAR-END
- ← COLLISION - HEAD-ON
- ← COLLISION - SIDESWIRE

7-74-3P

1-75-6P

4-74-4P

4-75-10A

8-74-P

8-74-9P

2-75-10P

6-75-10P

4-74-7P

10E
1-75-6P

5-75-4P

5-74-12A
1-75-6P

3-75-2A

- ← PATH OF PEDESTRIAN
- ← PATH OF VEHICLE
- ← PATH OF ANIMAL
- ← VEHICLE MOVING
- VEHICLE STOPPED
- VEHICLE BACKING
- PROPERLY PARKED
- IMPROPERLY PARKED
- ← VEHICLE OVERTURNED
- ← VEHICLE SKIDDED

COLLISION TYPE

TOTAL

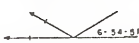
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE		1	2	3
HEAD-ON				
REAR-END			5	5
SIDESWIRE			4	4
TURNING MOVEMENT			2	2
PARKING			2	2
NON-COLLISION				
FIXED OBJECT				
PEDESTRIAN				
BACKING			1	1
MISO.				
TOTAL				17

REMARKS

INDICATE NORTH

6th St. N.W.
STREET OR ROADCentral Ave. West
STREET OR ROAD

EXAMPLE

COLLISION - SIDESWIRE
JUNE, 1954 - 5:08 PM
PROPERTY DAMAGENOTE LOCATION OF ANY TRAFFIC CONTROLS AT
INTERSECTION BY THE FOLLOWING SYMBOLS

- T STOP SIGN
- TWO WAY TRAFFIC SIGNAL
- FOUR WAY TRAFFIC SIGNAL

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT
ACCIDENT ANALYSIS

COLLISION DIAGRAM

CITY OF Gl Falls COUNTY Carbon
 INTERSECTION OF Cent W AND 6th
 HIGHWAY NUMBER _____
 PERIOD COVERED 6-67 CR
 COMPILED BY _____ DRAWN BY _____ DATE _____

LEGEND

- PASSENGER KILLED
- ▲ PEDESTRIAN KILLED
- PASSENGER INJURED
- △ PEDESTRIAN INJURED
- ← PROPERTY DAMAGE ONLY
- ←→ COLLISION - REAR-END
- ←→ COLLISION - HEAD-ON
- ←→ COLLISION - SIDESWIPE

INDICATE NORTH

- ←--- PATH OF PEDESTRIAN
- ←→ PATH OF VEHICLE
- PATH OF ANIMAL
- ← VEHICLE MOVING
- VEHICLE STOPPED
- ← VEHICLE BACKING
- ▭ PROPERLY PARKED
- ▭ IMPROPERLY PARKED
- ← VEHICLE OVERTURNED
- ← VEHICLE SKIDDED

EXAMPLE

COLLISION - SIDESWIPE
 JUNE, 1954 - 5:48 PM
 PROPERTY DAMAGE

NOTE LOCATION OF ANY TRAFFIC CONTROLS AT
 INTERSECTION BY THE FOLLOWING SYMBOLS
 T STOP SIGN
 + TWO WAY TRAFFIC SIGNAL
 + FOUR WAY TRAFFIC SIGNAL

COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE		1	2	3
HEAD-ON			1	1
REAR-END		7	22	29
SIDESWIPE			2	2
TURNING MOVEMENT		1	5	6
PARKING				
NON-COLLISION				
FIXED OBJECT				
PEDESTRIAN				
BACKING			4	4
MISD.		1		1
TOTAL		9	34	43

REMARKS _____

MONTANA HIGHWAY COMMISSION
TRAFFIC DEPARTMENT
ACCIDENT ANALYSIS
COLLISION DIAGRAM

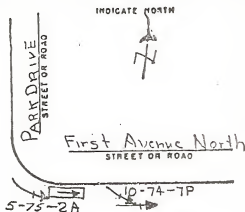
CITY OF Great Falls COUNTY CASCADE
INTERSECTION OF Park Drive AND First Avenue North
HIGHWAY NUMBER _____
PERIOD COVERED 11/17/74 7/30/75
COMPILED BY JACOBSON DRAWN BY _____ DATE 7/30/75

LEGEND

- PASSENGER KILLED
- ▲..... PEDESTRIAN KILLED
- PASSENGER INJURED
- ▲..... PEDESTRIAN INJURED
- PROPERTY DAMAGE ONLY
- ↔ COLLISION - REAR - END
- ↔ COLLISION - HEAD - ON
- ↔ COLLISION - SIDESWIPE

4-75-5P
6-75-4P
6-75-5P 8-74-8A
12-74-8P 6-74-2A
11-74-3P 1-74-8P
10-74-6P 6-74-4P
8-74-2A 10-3-74-10P

- ◄..... PATH OF PEDESTRIAN
- PATH OF VEHICLE
- ◄..... PATH OF ANIMAL
- VEHICLE MOVING
- ◄ VEHICLE STOPPED
- VEHICLE BACKING
- ☐ PROPERLY PARKED
- ☐ IMPROPERLY PARKED
- ↔ VEHICLE OVERTURNED
- ↔ VEHICLE SKIDDED



EXAMPLE

COLLISION - SIDESWIPE
JUNE, 1954 - 5:08 PM
PROPERTY DAMAGE

NOTE LOCATION OF ANY TRAFFIC CONTROLS AT INTERSECTION BY THE FOLLOWING SYMBOLS
T STOP SIGN
+ TWO WAY TRAFFIC SIGNAL
+ FOUR WAY TRAFFIC SIGNAL

COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP. DAMAGE	TOTAL
ANGLE			1	1
HEAD-ON				
REAR-END			16	16
SIDESWIPE			4	4
TURNING MOVEMENT			8	8
PARKING			2	2
NON-COLLISION				
FIXED OBJECT				
PEDESTRIAN				
BACKING			1	1
MISC.				
TOTAL				32

REMARKS

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT ACCIDENT ANALYSIS

COLLISION DIAGRAM

CITY OF Gr. Falls COUNTY C. & C.
INTERSECTION OF 1st Ave. N. AND Park Drive
HIGHWAY NUMBER _____
PERIOD COVERED 1966, 1967, 1968
COMPILED BY _____ DRAWN BY Reitz DATE _____

LEGEND

- PASSENGER KILLED
- PEDESTRIAN KILLED
- PASSENGER INJURED
- PEDESTRIAN INJURED
- ↑↑↑ PROPERTY DAMAGE ONLY
- ↑↑↑ COLLISION-REAR-END
- ↑↑↑ COLLISION-HEAD-ON
- ↑↑↑ COLLISION-SIDESWIP

INDICATE NORTH

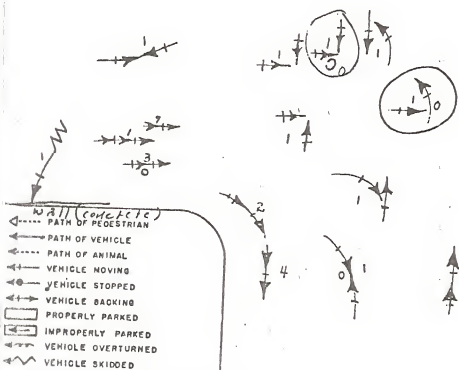
↑
N

signal
pole

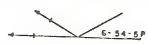
1st Ave. North
STREET OR ROAD

Park Drive
STREET OR ROAD

W 2



EXAMPLE



COLLISION-SIDESWIP
JUNE, 1954-5-8 PM
PROPERTY DAMAGE

NOTE LOCATION OF ANY TRAFFIC CONTROLS AT INTERSECTION BY THE FOLLOWING SYMBOLS

- T STOP SIGN
- T TWO WAY TRAFFIC SIGNAL
- ↑↑↑ FOUR WAY TRAFFIC SIGNAL

COLLISION TYPE	TOTAL		
	FATAL	INJURY	PROP. DAMAGE
ANGLE			
HEAD-ON		1	3
REAR-END		1	1
SIDESWIP		3	22
TURNING MOVEMENT		2	2
PARKING		1	2
DRN-COLLISION			
FIXED OBJECT		4	4
PEDESTRIAN			
ACKING			
ISO.			
TOTAL			29

REMARKS
 Right turner of Rear End accident to
 from the West approach could
 be reduced by a left turn lane
 signs on the approach and better
 progression of signal timing with
 signal at River Rd. & 1st Ave N.
 Turning Movement & 2 collisions
 could be reduced by providing separate
 phases for the heavy left turn
 movement from the South approach

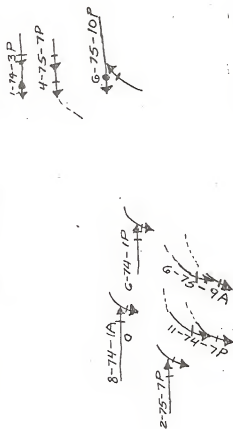
MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT
ACCIDENT ANALYSIS
COLLISION DIAGRAMCITY OF Great Falls COUNTY CASCADE
INTERSECTION OF Park Drive AND Central Ave.
HIGHWAY NUMBER _____
PERIOD COVERED 11/1/74 7/30/75
COMPILED BY JACOBSON DRAWN BY _____ DATE 7-30-75

LEGEND

- PASSENGER KILLED
- ▲..... PEDESTRIAN KILLED
- PASSENGER INJURED
- ▲..... PEDESTRIAN INJURED
- ↑↑↑ PROPERTY DAMAGE ONLY
- ↑↑↑ COLLISION-REAR-END
- ↑↑↑ COLLISION-HEAD-ON
- ↑↑↑ COLLISION-SIDESWIPE

- ▲..... PATH OF PEDESTRIAN
- PATH OF VEHICLE
- ▲..... PATH OF ANIMAL
- ↑↑ VEHICLE MOVING
- VEHICLE STOPPED
- ↑↑ VEHICLE BACKING
- PROPERLY PARKED
- INPROPERLY PARKED
- ↑↑ VEHICLE OVERTURNED
- ~ VEHICLE SKIDDED



INDICATE NORTH

Central Avenue
STREET OR ROADPark Drive
STREET OR ROAD

3-74-11P 9-74-3A
4-74-10P 8-74-3P
5-74-2A
6-74-11P
6-74-11P

10-74-9A 8-74-1P

EXAMPLE



COLLISION-SIDESWIPE
JUNE, 1954 - 5:56 PM
PROPERTY DAMAGE

NOTE LOCATION OF ANY TRAFFIC CONTROLS AT
INTERSECTION BY THE FOLLOWING SYMBOLS

- ⊥ STOP SIGN
- ⊥ TWO WAY TRAFFIC SIGNAL
- ⊥ FOUR WAY TRAFFIC SIGNAL

COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP. DAMAGE	TOTAL
ANGLE				
HEAD-ON				
REAR-END			8	8
SIDESWIPE				
TURNING MOVEMENT		1	6	7
PARKING			1	1
NON-COLLISION				
FIXED OBJECT				
PEDESTRIAN				
BACKING			1	1
MISO.				
TOTAL				17

REMARKS

BILLINGS

URBAN AREA

TOPICS EVALUATION REPORT

M-5112(2) & M-7111(1)

T-9010(19)

T-9010(18)

T-9010(20)

Prepared by

Montana Department of Highways

Billings Construction Division

July, 1974

M-5112(2) & M-7111(1) MONTANA AVENUE - FIRST AVENUE NORTH COUPLET

These projects utilized revisions to geometrics, signals, signing and striping to implement a one-way couplet from Division Street to 18th Street. As can be seen in Figure 1, Montana Avenue and 1st Avenue North run parallel through the CBD. Figure 1 illustrates the one-way grid system now in operation in Billings. The grid system was completed in conjunction with these projects.

Prior to construction, Montana Avenue was a two-way, two-lane, minor arterial which operated inefficiently due to the influence of train crossings and loading dock activities. Train movements blocked turns from Montana South, and at time all traffic movements were stopped on Montana when 29th, 28th and 27th Street traffic backed up North. Egress and Egress at the loading docks just West of 29th, blocked all but one lane on Montana through the duration of their activity.

Project preparations included an agreement with the railroad to realign the loading docks and refine their truck parking procedures. Montana Avenue is now a three lane, one-way arterial which allows at least two free lanes at all times for traffic movement. Signal revisions provide a railroad pre-empt phase that clears vehicles on the tracks, prohibits turning movements off Montana to the South, and gives a flashing amber indication to Eastbound traffic. Although data necessary to compute the present level of service (L.O.S.) is not available at this time, cursory observations would indicate a L.O.S.-B at peak hours despite a significant increase in traffic at all Montana Avenue Intersections.

As illustrated in Table 1, Average travel speeds through downtown East - West streets were compiled before and after conversion to a one-way system. A 50 percent increase in travel speed on Montana Avenue was recorded and a 53 percent increase on 1st Avenue North. These travel speeds evidenced the reduction in time of crosstown trips, for which there is significant demand.

TABLE 1 - AVERAGE TRAVEL SPEEDS - DOWNTOWN BILLINGS

STREET	DESCRIPTION	LENGTH (miles)	AVE. TRV. SPEEDS MPH	
			BEFORE	AFTER
Montana Ave.	Division to 18th	1.32	15.8	25.8
1st Ave. N.	18th to Division	1.28	14.8	22.6
2nd Ave. N.	Division to 25th	0.73	12.5	18.2
3rd Ave. N.	25th to Division	0.68	10.6	17.6

Recently the City - County Planning Board distributed a draft study on Volume Capacities for intersections in the Urban Area. These capacities were computed on 1973 data. The capacity calculations were taken from Traffic Engineering by Louis J. Pignataro and compiled as an overall intersection L.O.S. The draft study provides an excellent format for a before and after comparison. Since traffic operations are still in a period of transition, it was felt that extensive counts at every intersection would not remain valid as minor operational adjustments are

BILLINGS-CBD ONE WAY GRID SYSTEM

FEDERAL AID PROJECTS: T-9010(19)

M-5112(2)

M-7111(1)

CORE CBD

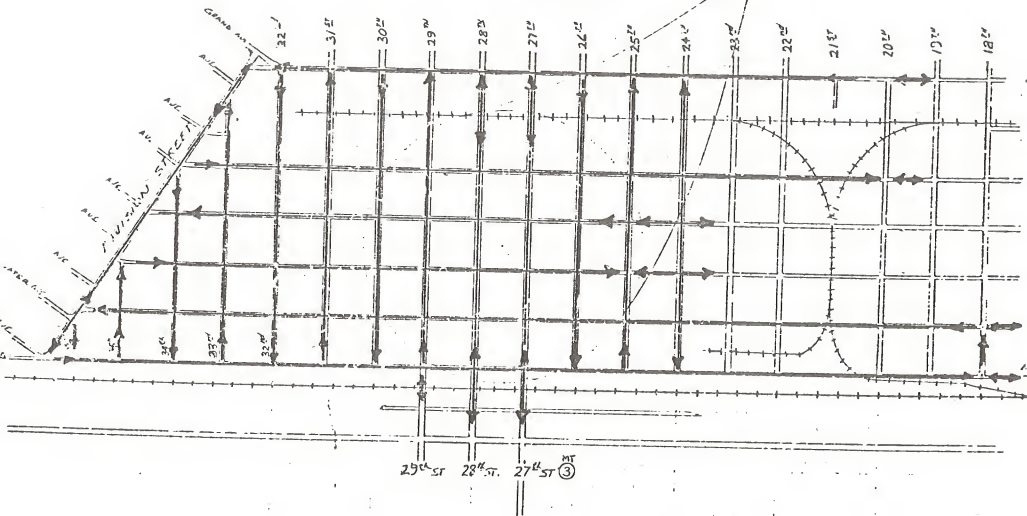


Figure 1. One-way Directional Designations - Billings

to be made. The intersection of 1st Avenue North and 27th Street was scrutinized since it had a prior Level of Service "E". Table 2 indicates the volume capacity changes resulting from the one-way system. As can be seen, the L.O.S. has been improved slightly and further improvements will result when 27th Street is incorporated in the one-way system.

TABLE 2 - VOLUME CAPACITY COMPARISON

	STREET	CAPACITY	VOLUME	LOAD FACTOR	L.O.S.
1973	{ 1st Avenue N.	1,702	776	.95	E
	{ 27th Street	1,547	553	.95	E
1975	{ 1st Avenue N.	3,939	1,480	.82	D
	{ 27th Street	1,642	600	.82	D

Since the accident time base is not sufficient enough for an after comparison, safety benefits cannot be computed at this time. It should be noted that the intersection of Division and 1st Avenue North had experienced a high accident rate prior to conversion that has since dropped drastically.

Operational problems noted deal mainly with lane usage and CBD circulation. The entire grid system of one-ways changed drivers habit patterns and motorists cling to outside lanes unnecessarily, which results in lane loading at off peak hours. The two remaining two-way streets (27th and 28th) attract more traffic than expected, probably due to motorist familiarity with their operation. The traffic load on these streets creates frequent backups during peak hours. These problems are expected to be reduced after motorists accept the change and create new habits. Circulation problems will be relieved by additional parking spaces provided by future parking structures.

T - 9010(19) DIVISION TO 31st, 6th AVENUE NORTH TO 1st AVENUE NORTH

This project involved signals and signing to incorporate this area into the downtown one-way grid system and to improve the traffic flow. Quantitative analysis is not possible at present due to the short period of time the one-way streets have been in operation.

Subjective observations indicate that these streets provide Level of Service "A" at all hours of the day as was experienced in the past. Side street delay has been reduced at 3rd Avenue North and 32nd with the installation of a fixed time signal.

Future accident analysis may show a more definitive benefit derived from this project.

T-9010(18) LEWIS AVENUE AND 8th STREET WEST

This project was completed in November 1974. The intent of the reconstruction was to remove a 130 foot offset jog in Lewis Avenue. Since the major traffic on Lewis is straight through, delay encountered by vehicle waiting to cross 8th Street West was excessive. The average amount of a vehicle required to cross 8th was six seconds. Motorist's awareness of this situation decreased the level of gap acceptance.

The new alignment has reduced the crossing distance to approximately half, proportionately reducing vehicle hours delay and increasing gap acceptance.

From January 1973 to September 1974, there were nine recorded accidents (Primarily rear end type). The computed accident rate is 0.99/MVE. Subsequent to the completion of this project in November 1974, nine accidents were recorded (Predominantly angle type). This accident rate is computed at 2.85/MVE, or an increase of 187 percent.

Improvements of this type normally do create a rash of accidents at first as was probably the case in this instance with 90% of the accidents occurring in the first three months of operation. It is further believed that the previous appearance of this intersection was sufficiently hazardous to cause motorists to exercise extreme caution. The present channelized intersection does not, by appearance, create a need for extra caution.

Additional accident data should reflect the motorists familiarity by a reduced accident rate. If future data does not support this contention, signalization should be considered.

T-9010(20) BROADWATER AND 16th STREET WEST

The operational characteristics of this intersection were not appreciably changed. The project involved upgrading the signal indications to M.U.T.C.D. Standards. An accident analysis will be conducted when a statistically significant time base is available.

APPENDIX

City of Anaconda
Program for Providing On-going Traffic Engineering Services

PERSONNEL

JOHN KAIN - City Engineer

Experience: 1955 - 1972 - Estimator and Field Engineer for various construction firms and consulting engineering firms in Montana.

1972 - 1974 - Physical Program Coordinator, Butte Model City Agency in charge of street improvements, sewer construction, sidewalk improvements, sewer study, demolition, park development, and parking facility design.

Education: Carroll College - 1951-52, Business Administration
MSU - 1955-57, Civil Engineering and Industrial Arts

Professional Registration: Certified Engineering Technician, Montana

JOSEPH DOWDALL - City Electrician

Experience: Electrician in charge of signal system design and maintenance, City of Anaconda, for past 20 years.

Technical Qualifications: Licensed Electrician, Montana

CLETE W. DAILY - Consulting Engineer

See attached Resume

ROBERT J. PECIOA - Consulting Engineer

See attached Resume

TRAFFIC ENGINEERING PROGRAM REVIEW PROCESS

In 1972, a Parking Authority was established under the provisions of Chapter 37, R.C.M. 1947. The Authority meets monthly or more frequently if required to review parking and traffic circulation problems. The Authority acts as an advisory agency to the City Council. Parking Authority meetings are attended by the Mayor, Chairman of the City Council Streets and Alleys Committee, City Engineer, Fire Chief, Police Chief, and the Traffic Consultant.

The final decision to implement traffic circulation, parking and related improvements is made by the City Council. Recommendations for improvements are set forth by a three-member Streets and Alleys Committee made up of Council members. A weekly report is made by the Chairman of this committee.

An Urban Transportation Plan was prepared for the City of Anaconda by the Montana Department of Highways in 1974. Traffic improvements are coordinated with this plan.

110: 3/11/74
cc: G. H. Kain
Ed. C. Kain
COPY

City of Anaconda

PROGRAM FOR PROVIDING ON-GOING TRAFFIC ENGINEERING SERVICES

Organization

Policies for traffic circulation and parking improvements are set forth by the Anaconda City Council. In 1972, a Parking Authority was established under the provisions of Chapter 37, R.C.M. 1947. The Authority acts as advisory agency to the City Council.

Staff

The City of Anaconda employs a City Engineer who has experience in the field of traffic engineering. The City Electrician is charged with the maintenance of traffic signals. The Chief of Police, Fire Chief and City Engineer attend meetings of the Parking Authority and are consulted on parking, traffic circulation improvements and emergency vehicle routing.

In addition to the local staff, the firm of Daily-Peccia and Associates, Helena, Montana are retained as consultants on an on-call basis. Professional traffic engineers from this firm attend City Council and Parking Authority meetings, conduct studies of specific problem areas and recommend improvements.

Consultants have been utilized to conduct a Traffic Control Device Study which resulted in upgrading traffic signs in the City and in the preparation of traffic circulation plans for the urban area.

The combination of local staff with professional traffic engineering consultation has proven effective in meeting the on-going traffic engineering function.

COPY

